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ABSTRACT

The percent and characteristics of children who produced invalid profiles on two different continuous performance tests (CPTs) tasks were examined. Sixty-one children referred for attention deficit hyperactivity disorder (ADHD) assessment and 24 non-clinical control children (all children ages 5-16) were given the Test of Variables of Attention (TOVA) and the Intermediate Visual and Auditory Continuous Performance Test (IVA) as part of a larger assessment battery. Results revealed that 19 percent of all subjects produced an invalid profile on the TOVA and 24 percent of subjects yielded an invalid profile on the visual and/or auditory scales on the IVA. The majority of invalid profiles on the IVA were produced by children diagnosed with ADHD. On the TOVA, a similar number of ADHD and control children produced invalid results in the second half of the test due to excessive anticipatory errors. Children under the age of 7 and those with an estimated IQ of less than 85 were more likely to produce invalid profiles on the IVA. Results suggest that a significant number of children referred for ADHD assessment are likely to produce invalid scales on these two commonly used CPT measures, indicating that CPT manuals and research should address this problem. (Author/DB)

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Who are the Invalids on Continuous Performance Tests ?

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Abstract

The percent and characteristics of children who produced invalid profiles on two different CPT tasks were examined. Sixty-one clinic-referred children and 24 non-clinical control children between the ages of 5 and 16 were given the Test of Variables of Attention (TOVA) and the Intermediate Visual and Auditory Continuous Performance Test (IVA) as part of a larger assessment battery. Results revealed that 19% of all subjects produced an invalid profile on the TOVA and 24% of subjects yielded an invalid profile on the visual and/or auditory scales on the IVA. The majority of invalid profiles on the IVA were produced by children diagnosed with ADHD. On the TOVA, a similar number of ADHD and control children produced invalid results in the second half of the test due to excessive anticipatory errors. Children under the age of seven and those with an estimated IQ of less than 85 were found to be more likely to produce invalid profiles on the IVA. Results suggest a need for greater consideration of invalid CPT profiles both in CPT manuals and in research examining the use of CPT's in ADHD assessment.

Purpose

Accurate diagnosis of attention-deficit/hyperactivity disorder is best achieved through multiple types of information from multiple sources (Barkley, 1990). Continuous performance tests (CPTs) are one helpful source of information, particularly in cases in which parent and teacher information are inconsistent. Although there is some inconsistency in the research, most studies comparing the performance of ADHD and normal children have reported significant differences (Corkum & Siegel, 1993; Losier, McGrath & Klein, 1996). There has been greater disagreement among studies that have compared ADHD children with other clinical groups (e.g. Shapiro & Garfinkel, 1986). Differences between types of CPT tasks and comorbid diagnoses are two factors which likely account for some of the lack of consistent findings in comparing ADHD children with other clinical groups (Losier et al., 1996). For example, ADHD children who display greater levels of conduct and psychosomatic problems have been found to be more likely to have normal CPT scores (Fischer, Newby & Gordon, 1995). One seldom considered factor in exploring inconsistencies in CPT research are invalid CPT profiles.

Children with ADHD have been found to consistently make more errors of omission and commission than normal children (Losier et al., 1996). In cases of extreme ADHD and/or comorbid behavioral problems, it might be expected that these errors of omission and commission would be even more extreme. Most CPT tasks include some type of validity scale which indicates if errors are extreme enough to invalidate all or part of the test (e.g. random responding). While it may be expected that ADHD children would be more likely to produce "invalid" profiles, this information is generally not reported in the current CPT research. In addition, base rates for invalid profiles are not mentioned in most CPT manuals. Consideration of invalid profiles is important both for research on CPTs and in the accurate use of CPTs in the diagnosis of attention deficit disorder.

Method

Participants

Participants included 61 clinic-referred and 24 normal control children who ranged in age from 6 to 16 years old (M = 8 years, 7 months; SD = 29 months). Clinic-referred participants were children consecutively referred by pediatricians, physicians, parents and teachers for ADHD assessment. Control children were recruited by asking teachers to nominate children with average cognitive ability and no behavior problems that were the same age and gender as a clinic-referred child in the same classroom. Parents of nominated children were then contacted by phone and invited to participate in the study. Control children were paid $20 for their participation. Participants were predominantly Caucasian and from middle-income households.

Procedure

All participants were given the Test of Variables of Attention (TOVA; Greenberg, 1996) and the Intermediate Visual and Auditory (IVA; Sanford, 1995) CPTs as part of a larger assessment battery. Testing was done in the morning and presentation of the two CPTs was counterbalanced, with other less demanding tests administered between the two CPTs. For clinic-referred children, the assessment data were reviewed independently by two licensed psychologists and a diagnosis was given based on DSM-IV criteria. In the event of a disagreement in diagnosis, a third psychologist reviewed the test data and provided a diagnosis. In cases in which 2/3 psychologists failed to agree on an initial diagnosis, the case was discussed by all three psychologists until an agreement regarding diagnosis was reached.

CPT Measures

The *Intermediate Visual and Auditory Continuous Performance Test* (IVA; Sanford, 1995) is a computer based continuous performance task. It is a 20-minute vigilance test wherein numbers are presented aurally and visually on a computer screen at the rate of 1 per second. The child is told to watch the screen and click on the mouse whenever the target stimulus is seen or heard. The IVA consists of nine specific measures that are highly sensitive to the primary symptoms of inattention and hyperactivity.

Invalid profiles on the IVA were defined as cases in which a subject scored in the lowest category of Comprehension errors (defined as omission and commission errors < 60% correct) for the auditory and/or visual Comprehension scales. Low Comprehension scores result from random responding due to difficulty in shifting mental sets and/or lack of understanding or motivation for the task. The IVA manual suggests that if low Comprehension scores are achieved for only one modality, that interpretation focus on the sensory domain which is valid. "If both of the comprehension scales are interpreted as invalid, the only limited analysis of other IVA test scale scores is possible" (Sanford & Turner, 1995, p. 4-2).

The *Test of Variables of Attention* (TOVA; Greenberg, 1996) is a nonlanguage-based 22.5 computerized test of attention. Rather than number or letters, the TOVA utilizes a large square on the computer screen with a smaller square embedded near the top or bottom edge of the large square as test stimuli. Stimuli are presented in a 2-second fixed-interval format, with targets presented infrequently in the first half of the test (prompting omission errors) and frequently in the second half of the test (prompting commission errors). The primary TOVA variables include errors of omission (inattention), errors of commission (impulsivity), response time and response time standard deviation.

Invalid profiles were defined as cases in which one or more invalid quarters were identified in the Analysis Table in the TOVA interpretive print-out. In the majority of cases, quarter 3 or quarter 4 were identified as invalid in the printout due to greater than 10% anticipatory errors in that quarter. In the case of an invalid quarter, the normative scores for that half of the test are considered invalid, thus limiting the amount of interpretable information overall.

Results

The percent of children with one or more invalid quarters on the Test of Variable Attention (TOVA) was 19%. On the Intermediate Visual and Auditory (IVA) CPT, 18% (n = 15) of participant profiles yielded an invalid visual scale, 1% (n = 1) produced an invalid auditory scale, and another 5% (n = 4) were invalid on both the visual and auditory scales. Table 1 provide descriptive information on age, gender, IQ and diagnosis for the valid and invalid cases on each CPT. The majority of participants with invalid visual scales on the IVA were children diagnosed with ADHD and co-morbid ODD, though two non-clinical control subjects also produced an invalid visual scale. Chi-square analyses revealed that children under the age of seven, and children with an estimated IQ of less than 85 were more likely to produce an invalid profile on the IVA (visual/auditory or both scales invalid). All four cases in which both visual and auditory scales of the IVA were invalid were children under the age of seven with a diagnosis of ADHD/ODD.

On the TOVA, an similar number of ADHD (n = 7) and normal control children (n = 8) produced invalid results in the third and forth quarters due to excessive anticipatory errors during the "high frequency" target presentation in the second half of the test. One ADHD and two non-ADHD clinical children with invalid quarters had below average IQ's. Only three children (15% of the total invalid sample) produced invalid results on both the TOVA and the IVA.

Discussion

The present findings suggest that CPT tasks which integrate visual and auditory stimuli, such as the IVA, should be used cautiously with younger children and children with low cognitive abilities who are likely to produce an invalid profile for all or part of the test. The frequency of visual-only invalid profiles, and infrequency of auditory-only invalid profiles suggests that ADHD children may be particularly likely to produce random responses to visual as opposed to auditory stimuli, thus CPTs with both an auditory and visual component may provide a more thorough assessment of attentional abilities. An auditory version of the TOVA has recently become available. In addition, a preschool version of the IVA, the PREVA, is currently being field tested. The PREVA includes both auditory and visual presentation of stimuli, but does not require the subject to discriminate between auditory and visual stimuli presented simultaneously, as the IVA does.

The similar percentage of control versus ADHD children with invalid third and forth quarters due to anticipatory errors on the TOVA (30% of control group) suggests that nonclinical factors such as boredom

and/or fatigue may account for excessive errors yielding invalid results. Finally, the lack of overlap between invalid scales on the IVA versus invalid quarters on the TOVA indicates that different factors account for different types of errors on the two CPTs. For the IVA, which presents greater cognitive demands in shifting mental sets between auditory and visual modes, cognitive abilities appear to play a key role in the child's ability to produce a valid profile. Contrary to previous research, ADHD children with oppositional tendencies frequently produced invalid results on the visual scale of the IVA, suggesting that behavioral difficulties may contribute to invalid profiles or that perhaps a common underlying factor contributes both to greater oppositional behavior and greater difficulty on CPTs.

These results suggest that a significant number of children referred for ADHD assessment are likely to produce invalid scales on two commonly used CPT measures. However, the CPT manuals provide very little information regarding the base rates for invalid scales or the interpretive significance. Sanford and Turner (1995) suggest that low comprehension scores on both visual and auditory modalities for the IVA, combined with frequent fine-motor hyperactivity as measured by another scale, is supportive of the diagnosis of ADHD. There is no research, however, presented in the manual to support this interpretation. Even less information regarding invalid quarters and their interpretive significance is presented in the TOVA manuals. Finally, there is very little mention of invalid scales or profiles in research examining the use of CPTs in ADHD assessment, perhaps accounting for some of the differences in results in this literature.

References

Barkley, R. (1990). Attention deficit hyperactivity disorder: A handbook for diagnosis and treatment. New York: Guilford.

Corkum, P.V. & Siegel, L.S. (1993). Is the continuous performance task a valuable research tool for use with children with attention-deficit-hyperactivity disorder ? Journal of Child Psychology and Psychiatry, 34, 1217-1239.

Fischer, M., Newby, R.F., & Gordon, M. (1995). Who are the fake negatives on continuous performance tests ? Journal of Clinical Child Psychology, 24, 427-433.

Greenberg, L.M. (1996). Test of Variables of Attention. Universal Attention Disorders, Inc.

Losier, B.J., McGrath, P.J., & Klein, R.M. 1996). Error patterns on the continuous performance test in non-medicated and medicated samples of children with and without ADHD: A meta-analytic review. Journal of Child Psychology and Psychiatry, 37, 971-987.

Sanford, J.A. (1995). Intermediate Visual and Auditory Continuous Performance Test. Braintrain: Richmond, VA.

Sanford, J.A. & Turner, A. (1995). Intermediate Visual and Auditory Continuous Performance Test: Interpretation Manual. Braintrain: Richmond, VA.

Shapiro, S.K. , & Garfinkel, B.D. (1986). The occurrence of behavior disorders in children: the interdependence of attention deficit disorder and conduct disorder. Journal of the American Academy of Child Psychiatry, 25, 809-819.

Table 1

Descriptive Information for children producing invalid scales or quarters on the TOVA and IVA

Variable	Invalid CPTs		Valid CPTs		Total Sample
	IVA	TOVA	IVA	TOVA	
Gender					
Male	65% (13)	87% (13)	77% (50)	71% (50)	74% (63)
Female	35% (7)	23% (2)	23% (15)	29% (20)	26% (22)
Age					
7 and under	55% (9)	7% (1)	3% (2)	14% (10)	13% (11)
Over age 7	45% (11)*	93% (14)	97% (63)	86% (60)	87% (74)
Estimated IQ					
85 and under	30% (6)	20% (3)	6% (4)	10% (7)	12% (10)
over 85	70% (14)**	80% (12)	94% (61)	90% (63)	91% (75)
Diagnosis					
ADHD-C	70% (14)	40% (6)	17% (11)	32% (19)	29% (25)
ADHD-I	15% (3)	0% (0)	13% (8)	18% (11)	13% (11)
Clinic-referred non-ADHD	10%) (2)	7% (1)	35% (23)	40% (24)	30% (25)
Non-clinical Controls	5% (1)	53% (8)	35% (23)	27% (16)	28% (24)

Note: ADHD-C = ADHD-Combined Type; ADHD-I = ADHD-Inattentive type; Non-ADHD = clinic referrals not diagnosed ADHD; number of subjects in parentheses

*Chi-square significant for Valid/Invalid IVA and Age ($p = .0001$)

** Chi-square significant for Valid/Invalid IVA and IQ group ($p = .004$)